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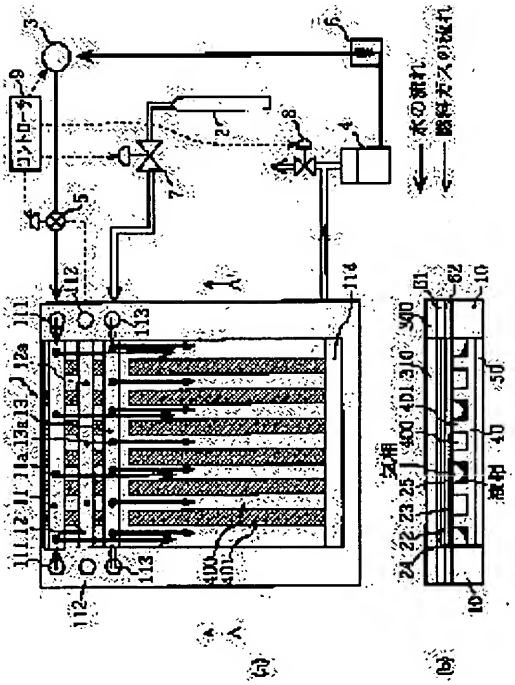
(54) SOLID POLYMER TYPE FUEL CELL AND ITS OPERATING METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a solid polymer type fuel cell in which fuel gas and water can be uniformly supplied to the entire cell, closure with a meniscus of a channel hardly occurs, and cell performance cannot be degraded as a time passes even if a flow rate of the water to be supplied to channels on an anode side is set small in the solid polymer type fuel cell for allowing the fuel gas and the water to flow in the channels on the anode side for the purpose of power generation.



SOLUTION: Fuel gas is supplied from a bomb 2 to a plurality of channels 400 on an anode side. A controller 9 changes over a changeover valve 5, so that water is alternately supplied from a pump 3 to a first channel group alternately selected from the channels 400 on the anode side and a second channel group alternately selected from the channels 400 on the anode side without overlapping with the first channel group.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Especially this invention relates to the polymer electrolyte fuel cell which generates electricity while supplying fuel gas and water to the channel by the side of an anode about a polymer electrolyte fuel cell.
[0002]
[Description of the Prior Art] The air as an oxidizer is supplied to a cathode, and a fuel cell supplies fuel gas to an anode, and generates electricity by making it react electrochemically generally in the cel which countered and arranged the cathode and the anode through the electrolyte membrane. And many of fuel cells put in practical use have structure to which what pinched the cel with the plate substrate of a pair with which the rib and the gas channel were formed was made into the basic unit, and the laminating of much them was carried out.
[0003] In the fuel cell of a solid-state macromolecule mold, although the solid-state poly membrane is used as an electrolyte membrane, in order to secure the ion conductivity of a solid-state poly membrane at the time of operation, many methods of moisturizing a solid-state poly membrane are taken by humidifying and supplying air and fuel gas from the former. Moreover, the method which fuel gas and water are supplied [method] and circulates them to each of two or more channels which counter an anode is also developed, and acquiring the cell property which in addition to the supply of hydrogen and the moisturization of a solid-state poly membrane to an anode cooled the cell and was efficiently excellent with this method is expected as indicated by JP,5-41230,A and JP,8-315839,A instead of the humidification method from such the former.
[0004]
[Problem(s) to be Solved by the Invention] By the way, in a polymer electrolyte fuel cell, in order to acquire the outstanding cell property, it is required for the whole cel to spread fuel gas and moisture. Therefore, it is necessary to each channel to distribute fuel gas and water to the above anode side channels in homogeneity in the method which supplies fuel gas and water.
[0005] However, since the channel to which water is easy to be supplied in fact, and the channel which is hard to be supplied arise in case water is distributed to two or more anode side channels, In order to make it water spread round the whole cel, water quite more superfluous than a complement had to be supplied to moisturization of a solid-state poly membrane, therefore the problem of the need in a mass thing was in the problem that the distribution to the anode of fuel gas is barred, and the water pump.
[0006] On the other hand, in the polymer electrolyte fuel cell which this invention person etc. proposed by Japanese Patent Application No. No. 124221 [nine to], while distributing fuel gas to the inlet-port section of each anode side channel, pore is established in a fixed configuration in the inlet-port section of each anode side channel, and water was distributed to each channel from the pore. When according to this polymer electrolyte fuel cell it takes into consideration that to realize compact fuel cells, such as portable, is desired although water can be distributed to each anode side channel in homogeneity even if the flow rate of the water to supply is comparatively small, to stop the amount of supply of water low further, and to perform the simplification and laborsaving of equipment is desired.
[0007] Then, this invention person etc. proposed the polymer electrolyte fuel cell which supplies fuel gas to an anode side [two or more] channel, and supplied water to the specific channel in an anode side [two or more] channel (for example, channel chosen every other from anode side [two or more] channels) in Japanese Patent Application No. No. 257330 [nine to] further. According to this configuration, since water is supplied only to a specific channel, water can be distributed in homogeneity also in the comparatively small amount of feedwaters. Moreover, although only fuel gas is supplied to channels other than a specific channel in an anode side [two or more] channel, since the circulating water evaporates and diffuses a specific channel, a solid-state poly membrane can be moisturized over the whole cel.
[0008] However, also in such a fuel cell, since water flows continuously to a specific channel, when it is

easy to generate lock out of a channel and this lock out arises by forming the meniscus of water in a channel trailer, the Li passage-of-time target with the uneven distribution to the anode of fuel gas has the problem that the cel engine performance falls. In the polymer electrolyte fuel cell indicated about this point by above-mentioned Japanese Patent Application No. No. 257330 [nine to], although he is trying to maintain homogeneity-distribution of fuel gas by securing the byroad of fuel gas to the downstream of a channel, a technique in which the channel lock out itself can be suppressed is also desired.
[0009] It is made in view of such a technical problem, this invention can supply fuel gas and moisture to the whole cel in homogeneity, even if it sets small the flow rate of the water which supplies fuel gas and water to an anode side channel in the polymer electrolyte fuel cell which is circulated and is generated as an anode side channel, and it aims at offering that of the potato of a fall of the cel engine performance with time that it is hard to produce the lock out by the meniscus of a channel further.
[0010]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, in this invention, it sets to a polymer electrolyte fuel cell. A fuel gas supply means to supply fuel gas to an anode side [two or more] channel, A 1st water supply means to supply water to the 1st channel group chosen from anode side [two or more] channels, It was made to make it perform, having established a 2nd water supply means to supply water to said 2nd channel group chosen from the anode side channels of a book, and switching the water supply by the 1st water supply means, and the water supply by the 2nd water supply means by turns without overlapping the 1st channel group. [two or more]
[0011] According to this configuration, since water is supplied to either the 1st channel group and the 2nd channel group in the same time amount, water can be distributed in homogeneity also in the comparatively small amount of feedwaters. Moreover, fuel gas is continued and supplied to each of the 1st channel group and the 2nd channel group.
[0012] Although water is intermittently supplied to each of the 1st channel group and the 2nd channel group, water's piling up in each channel to some extent and the steam generated within a channel can moisturize a solid-state poly membrane over the whole, if it takes being spread also in the next channel into consideration and switch actuation will be suitably performed in the selection list of the 1st channel group and the 2nd CHANRU group.
[0013] And since it does not say that water is continuously supplied to each anode side channel, the lock out by the meniscus of a channel can also be suppressed and degradation of the cel engine performance by water with time can also be reduced. Moreover, in the polymer electrolyte fuel cell, in order to attain the above-mentioned purpose, while supplying water, switching to the 1st channel group chosen from anode side [two or more] channels, and the 2nd channel group chosen from anode side [two or more] channels, without overlapping the 1st channel group concerned by turns, fuel gas was supplied by this invention, switching to the 1st channel group and the 2nd channel group by turns.
[0014] And according to this configuration, since water is supplied to either the 1st channel group and the 2nd channel group in the same time amount, water can be distributed in homogeneity also in the comparatively small amount of feedwaters. Moreover, since fuel gas will be intermittently supplied while water is intermittently supplied to each of the 1st channel group and 2nd channel group, and water and fuel gas are diffused to some extent, if switch actuation is suitably performed in the selection list of the 1st channel group and 2nd CHANRU group, a solid-state poly membrane can be moisturized in the supply list of fuel gas in homogeneity over the whole cel.
[0015] And since it does not say that water is continuously supplied to each anode side channel for a long time, the lock out by the meniscus of a channel can also be lessened and degradation of the cel engine performance by water can also be reduced. Here, the 1st circulation way leading to the inlet port of the 1st channel group and the 2nd circulation way leading to the inlet port of the 2nd channel group are prepared, and if water and fuel gas are switched by turns and supplied to this 1st circulation way and the 2nd circulation way, it can consider as a comparatively simple cell configuration.
[0016] Moreover, in the structure of the above-mentioned polymer electrolyte fuel cell, when the anode side [two or more] channel is formed on the 1st plate at juxtaposition, in case the 2nd channel group chooses it as the 1st channel group list, it is desirable to choose every [every other or] two from anode

side [two or more] channels, when moisturizing a solid-state poly membrane in the supply list of fuel gas in homogeneity over the whole cel.

[0017]

[Embodiment of the Invention] [Gestalt 1 of operation] Drawing 1 is the assembly drawing of the cel unit 100 which constitutes the polymer electrolyte fuel cell 1 (only henceforth "a fuel cell 1") concerning the gestalt of this operation. The cel 20 which the cel unit 100 arranges a cathode 22 and an anode 23 on the one side side (drawing 1 top-face side) of the rectangle-like frame 10 at the solid-state poly membrane 21, and becomes as shown in this Fig., The cathode side channel substrate 30 with which two or more cathode side channel 311 -- was formed in parallel is inserted in. It inserts in, and the anode side channel substrate 40 of a frame 10 with which two or more anode side channel 400 -- was formed in the side (drawing 1 inferior-surface-of-tongue side) in parallel on the other hand, and a dashboard 50 are crowded, and are constituted. In addition, in drawing 1 , since an anode 23 is in the tooth-back side of the solid-state poly membrane 21, it is expressed as the broken line.

[0018] The cel 20 is held in the condition of having been pinched with the cathode side channel substrate 30 and the anode side channel substrate 40, fuel gas flows in the direction shown by the void arrow head of drawing 1 , air flows in the direction shown in cathode side channel 311 -- by the thick wire arrow head of drawing 1 , and a generation of electrical energy is made by anode side channel 400 -- in a cel 20. As fuel gas, reformed gas, pure hydrogen gas, etc. which use hydrogen as a principal component are usually used.

[0019] In addition, in each drawing used for explanation of this operation gestalt, although seven anode side channel 400 -- is drawn in order to give explanation simple, many channels are usually formed more. The predetermined number laminating of this cel unit 100 is carried out, those both ends are pinched with the end plates 71 and 72 (refer to un-illustrating and drawing 2 in drawing 1) of a pair, and the fuel cell 1 is constituted.

[0020] A frame 10 receives a rectangle-like board. In the center section of the fuel gas circulation direction by the side of the one side (drawing 1 top-face side) The notch 101 for inserting in the above-mentioned cel 20 and the cathode side channel substrate 30 is formed. On the other hand, to a side (drawing 1 inferior-surface-of-tongue side) The crevice 103 in which the anode side channel substrate 40 and a dashboard 50 are inserted is formed. Further in the center section of the notch 101 It is the configuration in which the aperture 102 was established so that the anode side channel substrate 40 and an anode 23 can contact, and it is produced by carrying out the injection molding of the plastic material.

[0021] The manifold hole 113 and slotted hole 123 of a pair for supplying the manifold hole 111 of the pair for supplying water, a slotted hole 121 and the manifold hole 112 of a pair, a slotted hole 122, and fuel gas to the fuel gas circulation direction upstream section of a frame 10 are established in order. In addition, each slotted holes 121-123 are formed in the direction which intersects perpendicularly with anode side channel 400 --, and are open for free passage with each manifold holes 111-113 at the both ends.

[0022] The manifold hole 114 for discharging the fuel gas and water of a frame 10 unreacted to the fuel gas circulation direction downstream is established in the direction which intersects perpendicularly with anode side channel 400 --. The solid-state poly membrane 21 is a thin film which consists of perfluorocarbon sulfonic acid. A cathode 22 and an anode 23 are the layers of the predetermined thickness made from platinum support carbon, and adhesion molding is carried out with the hotpress in the center section of the solid-state poly membrane 21.

[0023] The channel substrate 310 inserts in and is crowded in a frame 300, and the cathode side channel substrate 30 is constituted. The channel substrate 310 is a plate-like member which consists of a carbon porous body, and the channel 311 which circulates air is formed in the cathode 22 and the field (it is an inferior surface of tongue at drawing 1) which counters.

[0024] A frame 300 consists of plastic material in the configuration in which the aperture 303 was established in the monotonous rectangle-like center, and the channel 302 for deriving the channel 301 and air for introducing air into a channel 311 from a channel 311 is formed in the field (drawing 1 top-face side) of the opposite side with the cathode 22 side. In addition, a gasket 61 intervenes between a cel

20 and the cathode side channel substrate 30, and the gasket 62 intervenes between a cel 20 and a notch 101.

[0025] While being the carbon porous body of the shape of a rectangle of smallness size a little and forming two or more anode side channels 400 of each other in parallel from the frame 10, as for the anode side channel substrate 40, the rib 401 is formed between channels 400. This anode side channel substrate 40 consists of upper section 40b and downstream 40c which were installed from center-section 40a located in the center of the fuel gas circulation direction, and this center-section 40a, and the height of a rib 401 is highly set up rather than upper section 40b and downstream 40c in center-section 40a. And high partial 401a of this rib 401 contacts the above-mentioned aperture 102 electrically with an anode 23 by **********.

[0026] In addition, although omitted in drawing 1 , between the anode 23 and the anode side channel substrate 40, the charge collectors 24 and 25 which consist of carbon paper which gave ******** are inserted in the list between a cathode 22 and the cathode side channel substrates 30 (refer to drawing 3 and (b) of 4). A dashboard 50 is an airtight glassy carbon plate of size equivalent to the anode side channel substrate 40, it intervenes between the cathode side channel substrate 30 and the anode side channel substrate 40, and is allotted, and it is making the work which prevents the abouchement of the fuel gas which flows the air which flows cathode side channel 311 --, and anode side channel 400 --, flowing through both electrically.

[0027] Drawing 2 is the perspective view showing operation actuation in the overall configuration list of a fuel cell 1. Moreover, drawing 3 and 4 are the explanatory views showing the configuration and operation actuation of a fuel cell 1, in each drawing, (a) shows the top face of the cel unit 100 typically, and (b) shows the A-A' cross section typically. In addition, in drawing 3 and 4, the flow of a thick wire arrow head and fuel gas is expressed for the flow of the water at the time of operation as the void arrow head, and the time zone operated in the state of the time zone in the condition of drawing 3 operated and drawing 4 at the time of operation is repeated by turns.

[0028] As shown in drawing 2 , at the time of operation, a fuel cell 1 is arranged so that the circulation way (cathode side channel) of air may be horizontally suitable. In the example of drawing 2 , it supposes that it is a fuel gas source of supply, and the hydrogen chemical cylinder 2 is used. The fuel gas from a fuel gas source of supply is distributed to each cel unit 100 from the manifold hole 113, in each cel unit 100, is distributed to upper section 40b of the anode side channel substrate 40 from a slotted hole 123, and flows anode side channel 400 -- to the downstream, and hydrogen gas is supplied to an anode 23 by this.

[0029] On the other hand, air is sent into channel 301 -- from the fan who does not illustrate. This air supplies oxygen to a cathode 22, circulating cathode side channel 311 --, and is discharged besides a cell from channel 302 --. The water sent out from a water pump 3 is supplied to the manifold hole 111 and the manifold hole 112. The supplied water is distributed to each cel unit 100, in each cel unit 100, is distributed to upper section 40b of the anode side channel substrate 40 from the manifold hole 111 or the manifold hole 112, and flows anode side channel 400 -- to the downstream, and the solid-state poly membrane 21 is moisturized by this. In addition, although mentioned later in detail, water is supplied, switching by turns by the diverter valve 5.

[0030] The unreacted hydrogen and water which passed anode side channel 400 -- are discharged besides a cell through the manifold hole 114, and flow into a liberating tank 4. And it is cooled with a condensator 6 and the water collected with the liberating tank 4 is again supplied to a fuel cell 1 from a water pump 3. The output of a water pump 3 measures the water pressure in the slotted hole 121 for water supply, and it adjusts it so that this value may turn into a predetermined water pressure value.

[0031] On the other hand, a regulator 7 adjusts the supply pressure of hydrogen gas. About 100-800mmH2O is usually suitable for this pressure. Moreover, a regulator 8 adjusts the pressure of the unreacted hydrogen discharged. This exhaust pressure force is adjusted so that the fuel utilization rate in a fuel cell 1 may become 90% or more. The drive of a water pump 3, switch actuation of a diverter valve 5, adjustment of regulators 7 and 8, etc. are controlled by the controller 9.

[0032] (Detailed explanation about the device which supplies water and fuel gas to an anode side

channel) it is shown in drawing 1 -- as -- an anode side channel -- the upper section -- setting -- the slotted hole 121 for the above-mentioned water supply -- the distribution substrate 13 is inserted [the distribution substrate 11] in the slotted hole 123 for fuel gas supply for the distribution substrate 12 through a gasket (un-illustrating) at the slotted hole 122 for water supply.

[0033] Pore 11a, pore 12a, and pore 13a are all established by long picture-like sheet metal, and these distribution substrates 11, 12, and 13 are installed in contact with upper section 40b of the anode side channel substrate 40. And in each of the distribution substrate 11 and the distribution substrate 12, it is the anode side channel 400 to pore 13a being established by the distribution substrate 13 corresponding to all anode side channel 400 --. -- Corresponding to the 1st channel group and the 2nd channel group which were chosen from the whole, pore 11a and pore 12a are established.

[0034] When a controller 9 switches and controls a diverter valve 5 at the time of operation of a fuel cell 1, the water sent out from a water pump 3 is switched and supplied to the manifold hole 111 and manifold hole 112 side. Therefore, as shown in drawing 3 , when water is supplied to the manifold hole 111 side from the diverter valve 5, fuel gas and water are supplied to the 1st channel group (1 and 3 from the left, 5 or 7th channel), and only fuel gas is supplied to the 2nd channel group (2 from the left, 4 or 6th channel). Although water is not supplied to the 2nd channel group at this time, since the water supplied to the 1st channel group evaporates and it is spread also in the next 2nd channel group, on the whole, the solid-state poly membrane 21 is moisturized. Thus, supply of the hydrogen to the whole anode and moisturization of the whole solid-state poly membrane are made.

[0035] Conversely, as shown in drawing 4 , when water is supplied to the manifold hole 112 side from the diverter valve 5, fuel gas and water are supplied to the 2nd channel group, and only fuel gas is supplied to the 1st channel group. Supply of the hydrogen gas to the whole anode and moisturization of the whole solid-state poly membrane are made by the reason same also at this time as the above. Here, it is the anode side channel 400. -- Based on what kind of criteria the 1st CHANRU group and the 2nd channel group being chosen from the whole and the design of a fuel cell 1 are faced, and it is the anode side channel 400. -- It considers as follows whether which inner channel should be made to correspond and pore 11a and pore 12a should be formed.

[0036] It is thought that the 1st channel group and the 2nd channel group are good to choose so that it may not lap mutually, namely, so that both pore 11a and pore 12a may not be formed to the same channel. Moreover, also in any of the 1st channel group and the 2nd channel group, consideration of that it is hard to diffuse it in the left channel although the water supplied to the channel is diffused good in the adjoining channel considers it good to choose so that spacing of channels may not separate too much so that the selected channel may be distributed over the whole front face of the anode side channel substrate 40.

[0037] In other words, it is desirable to carry out by every other or every 2, when [of anode side channel 400 --] choosing the 1st channel group from inside, and to carry out by every other or every 2, also when choosing the 2nd channel group, and it can say that it is not desirable to fly three or more and to choose. From such a viewpoint, as a desirable example As shown in drawing 3 and 4, the channel (it sets to drawing 3 and 4 and they are 1, 3, and the 5 or 7th channel from Hidari) of anode side channel 400 -- chosen from inside every other is made into the 1st channel group. channels other than the 1st channel group (it sets to drawing 3 and 4 and they are 2 and the 4 or 6th channel from Hidari) -- choosing all and considering as the 2nd channel group -- mentioning -- ****.

[0038] As other examples, it is the anode side channel 400 as the 1st channel group. -- It chooses from inside every two (1 from the left, 4 or 7th channel). Channels other than the 1st channel group (2 and 3 from the left, 5 or 6th channel) are chosen as the 2nd channel group, or the 2nd channel group is also mentioned by the thing of anode side channel 400 -- chosen from inside every two (the left to 2 or 5th channel).

[0039] As an example of the distribution substrate 11, the distribution substrate 12, and the distribution substrate 13, the thing which established pore by etching to metal (stainless steel of SUS304 and SUS316 grade, Ti steel) sheet metal or the sheet metal made from the ceramics (aluminum2O3 grade), or the thing which established pore to the sheet metal (a polyester system, an ABS system, par phenyl

oxide system, etc.) made from plastics can be mentioned.
[0040] each pore 11a established by the distribution substrate 11 and each pore 12a established by the list at the distribution substrate 12 are the same configuration (for example, circular, an ellipse form, a polygon) and the same magnitude, and its number is also the same (for example, every 1 per channel, and every two pieces -- or three pieces are formed at a time). When water passes Pores 11a and 12a, as for the thickness of the distribution substrates 11 and 12, or the aperture of Pores 11a and 12a, it is desirable to set up so that moderate resistance (pressure loss) may arise, and it is desirable to set up the aperture of 120 micrometers - 5mm and pore 11a for the thickness of a substrate within the limits of 20 micrometers - 3mm practical.
[0041] (Explanation about the effectiveness of the fuel cell of this operation gestalt) If the porous substrate was temporarily used as a distribution substrate, much water circulates in the part near the manifold hole 111 of a distribution substrate, and water cannot circulate easily in a part far from the manifold hole 111. On the other hand, since water does not flow out of pore unless a certain amount of water pressure is poured when the distribution substrate with which the pores 11a and 12a of a predetermined configuration were established is used like this operation gestalt, water can be distributed in [case / where a porous substrate is used] homogeneity.
[0042] Furthermore, at this operation gestalt, it is the anode side channel 400. -- Since water is not continuously supplied to all but it supplies by turns to the 1st channel group and the 2nd channel group, the amount of feedwaters can distribute water in homogeneity comparatively at least, and can moisturize the solid-state poly membrane 21 in the whole field of an anode 23. Moreover, it is the anode side channel 400 temporarily. -- Supposing water is continuously supplied to all or a specific channel for a long time, the meniscus of water will be formed in the termination of the channel, and it will be easy to generate lock out of a channel.
[0043] However, since water is supplied to the 1st channel group and the 2nd channel group by turns in the case of this operation gestalt, it is not continuously said to each channel for a long time that water is supplied. Therefore, while also being able to reduce lock out of the channel by the meniscus, the fall of the cel engine performance by lock out with time is also reduced. In addition, it thinks that this switching time spacing is good to usually set up in several seconds - about dozens of minutes since it will be expected that such effectiveness fades, if switching time spacing of a diverter valve 5 is set up not much long, and is ****.
[0044] Moreover, since moisturization of the solid-state poly membrane 21 in the time zone is fully made even if there are some time zones when water is supplied to neither [the interval of the time zone when water is supplied to the 1st channel group, and the time zone when water is supplied to the 2nd channel group, and] the 1st channel group nor the 2nd channel group, since there is water retention capacity in the anode side channel substrate 40, there is no problem on operation.
[0045] therefore, switch actuation of the diverter valve 5 by the controller 9 -- so much -- quick -- it is not necessary to carry out -- the general electromagnetism as a diverter valve 5 -- what is necessary is just to use a diverter valve Moreover, since ******** is given, in the inside of a channel 400, the contact angle of the water to the front face of the anode side channel substrate 40 of the charge collector 25 which uses the carbon porous body of a hydrophilic property for the anode side channel substrate 40, and is arranged on the anode 23 with this operation gestalt is smaller than the contact angle of the water to the front face of a charge collector 25.
[0046] Therefore, as shown in drawing 3 and (b) of 4, when water and fuel gas flow, the inclination divided into the liquid phase and a gaseous phase produces the inside of a channel 400. That is, since it flows after being drawn by water to the substrate 40 side, the liquid phase which is mainly from water on the anode side channel substrate 40 side existing and the gaseous phase which mainly consists of fuel gas and a steam having existed in the anode 23 (charge collector 25) side, supply of the fuel gas to an anode 23 is made efficiently.
[0047] [Gestalt 2 of operation] Although the fuel cell of the gestalt of this operation is the same as the fuel cell 1 of the gestalt 1 of the above-mentioned implementation almost Setting with the gestalt 1 of operation at the time of operation, fuel gas is the anode side channel 400. -- While supplying succeeding

the whole In the gestalt of this operation, the points supplied while switching by turns to the 1st channel group and the 2nd channel group about both fuel gas and water differ to having supplied switching water by turns to the 1st channel group and the 2nd channel group.
[0048] The semantics 400 of the 1st channel group here and the 2nd channel group, i.e., an anode side channel, -- The criteria at the time of choosing the 1st channel group and the 2nd channel group from the whole are as the gestalt 1 of operation having explained. Hereafter, the fuel cell of this operation gestalt is explained still more concretely. Drawing 5 and drawing 6 are the explanatory views showing the configuration and operation actuation of the fuel cell of this operation gestalt, and the time zone operated in the state of the time zone operated in the state of drawing 5 and drawing 6 is repeated by turns at the time of operation. In addition, in these drawings, the same number is given to the same component as the gestalt 1 of operation.
[0049] In the fuel cell of this operation gestalt, as shown in drawing 5 and 6, it sets in the upper section of an anode side channel. The manifold hole 111 of a pair, a slotted hole 121 and the manifold hole 112 of a pair, and the slotted hole 122 are established in order by the frame 10. The distribution substrate 12 is inserted in a slotted hole 121, and the distribution substrate 12 is inserted in a slotted hole 122 for the distribution substrate 11 at the slotted hole 122 for fuel gas supply. To each of the distribution substrate 11 and the distribution substrate 12 Anode side channel 400 -- About the point that pore 11a and pore 12a are established corresponding to the 1st channel group and the 2nd channel group which were chosen from the whole, it is the same as that of the gestalt 1 of operation.
[0050] However, the manifold hole 113 or slotted hole 123 for fuel gas which were formed with the fuel cell 1 of the gestalt 1 of operation are not formed. Moreover, with this operation gestalt, diverter-valve 5b connected with diverter-valve 5a connected with the manifold hole 111 and the manifold hole 112 is prepared, and piping of fuel gas and water is connected to each of diverter valves 5a and 5b.
[0051] diverter-valve 5a and diverter-valve 5b -- for example, electromagnetism -- it is a cross valve, and by switching and controlling diverter-valve 5a and diverter-valve 5b by the controller 9, to this manifold hole 111 and the manifold hole 112, at the time of operation, fuel gas and water are switched by turns, and are supplied at it. It will be supplied while fuel gas and water switch by turns to the 1st channel group and the 2nd channel group by this. That is, like drawing 5 , while water is supplied to the manifold hole 111 from diverter-valve 5a, in the time zone when fuel gas is supplied to the manifold hole 112 from diverter-valve 5b, water is supplied to the 1st channel group and fuel gas is supplied to the 2nd channel group. On the other hand, like drawing 6 , while fuel gas is supplied to the manifold hole 111 from diverter-valve 5a, in the time zone when water is supplied to the manifold hole 112 from diverter-valve 5b, fuel gas is supplied to the 1st channel group, and water is supplied to the 2nd channel group.
[0052] Thus, with this operation gestalt, although change-over supply also of the fuel gas is carried out at the 1st channel group and the 2nd channel group, since dispersibility is good, the hydrogen in fuel gas is diffused good also in the adjoining channel. Therefore, hydrogen will spread over the whole anode 23. Since the distribution substrate with which the pores 11a and 12a of a predetermined configuration were established uses like the gestalt 1 of operation also in this operation gestalt Since water can be distributed in homogeneity and it supplies by turns to the 1st channel group and the 2nd channel group, the amount of feedwaters can distribute water in homogeneity comparatively at least, and can moisturize the solid-state poly membrane 21 in the whole field of an anode 23. Moreover, since water is supplied to the 1st channel group and the 2nd channel group by turns, while also being able to reduce lock out of the channel by the meniscus, the fall of the cel engine performance by lock out with time can also be reduced.
[0053] Moreover, it is the same as that of the gestalt 1 of operation that the inclination for the liquid phase and a gaseous phase to be separated when vapor-liquid mixture flows produces the inside of a channel 400, and supply of the fuel gas to an anode 23 is made efficiently. Although the configuration of the switch device of fuel gas is somewhat complicated with the gestalt of this operation as compared with the gestalt 1 of operation, since there is neither the manifold hole 113 nor a slotted hole 123 in a frame 10, cell structure is simpler.

[0054] In addition, the time zone when water is supplied to the 1st channel group at, and fuel gas is supplied to the 2nd channel group also in this operation gestalt like the gestalt 1 of operation, Even if there is a time zone when fuel gas is supplied at to both [an interval with the time zone when water is supplied to the 2nd channel group at, and fuel gas is supplied to the 1st channel group, and] the 1st channel group and the 2nd channel group, and water is not supplied Since moisturization of the solid-state poly membrane 21 in the time zone is fully made, there is no problem on operation.
[0055] (modification etc.) Although the gestalten 1 and 2 of the above-mentioned implementation showed the example which performs a supply switch of fuel gas in the supply switch list of water between the 1st channel group and the 2nd channel group, the thing of anode side channel 400 -- for which the 1st - the 3rd channel group are chosen from inside, and water and fuel gas are switched and supplied to the 1st - the 3rd channel group in order is also possible.
[0056] In this case, anode side channel 400 -- In inside to the 1st channel group, 1, the 4 or 7th channel, and the 2nd channel group should just choose a channel from the left every two, in case the left to the 2 or 5th channel and the 3rd channel group choose each channel group like 3 or the 6th from the left. Moreover, although the gestalten 1 and 2 of the above-mentioned implementation showed the example which uses a carbon porous body to the anode side channel substrate 40, this substrate is also producible by carrying out mold shaping of a carbon ingredient and the resin. However, the carbon plate manufactured with mold shaping is precise, and since it is in an inclination deficient in water holding capacity, it is desirable by laying a hydrophilic ingredient to the inside of the anode side channel 400 to secure water retention.
[0057] Moreover, although the cathode side channel substrate 30 and the anode side channel substrate 40 were another objects with the gestalt of the above-mentioned implementation, it is also possible to carry out a carbon plate similarly using the bipolar plate cut and produced, for example. Moreover, with the gestalt of the above-mentioned implementation, although unreacted hydrogen and water are discharged besides the cell through the manifold hole 114, you may use together with the configuration which secures the outflow way only for fuel gas to the channel downstream currently indicated by Japanese Patent Application No. No. 257330 [nine to].
[0058]
[Example] [Example 1] Based on the gestalt 1 of operation, the fuel cell to which the 16-piece cel laminating of the cel unit was carried out by the following specifications was produced.
Electrode surface product : 100cm2 solid-state poly membrane : Perfluorocarbon-sulfonic-acid film anode : Carbon cathode which supported Pt-Ru : The carbon distribution substrates 11 and 12 which supported Pt: What established the pore of 0.2mm of apertures to SUS316 with a thickness of 0.15mm.
[0059] [Example 2] Based on the gestalt 2 of operation, the fuel cell to which the 16-piece cel laminating of the cel unit was carried out was produced. The specification is the same as that of an example 1.
[Example of a comparison] Although the fuel cell of this example of a comparison is the same configuration as the above-mentioned example 2, pore is formed to all anode side channel 400 --, there is no switch device, water is continuously supplied to the manifold hole 111, and fuel gas is continuously supplied to the manifold hole 112 at each of the distribution substrate 11 and the distribution substrate 12.
[0060] Therefore, in this example of a comparison, both water and fuel gas are continuously supplied to all anode side channel 400 -- during operation.
[Experiment 1] It operated changing the amount of the cooling water to supply on condition that the following using the cell of examples 1 and 2 and the example of a comparison, and the average cel electrical potential difference (mV) was measured.
[0061]
Current density : 0.5 A/cm2 fuel gas : H2/CO2 (80/20: flow rate)
Oxidizer : Air fuel gas utilization factor : Rate of 60% oxidation gas utilization : 15% drawing 7 is the property Fig. which shows this experimental result and expressed the circulating water flow per cel unit, and relation with an average cel electrical potential difference (mV).

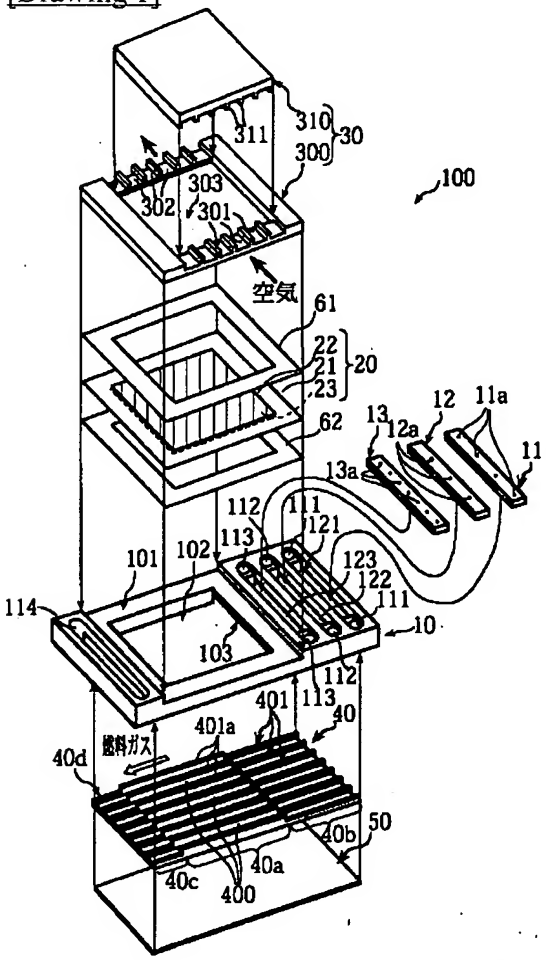
[0062] Although the high cel electrical potential difference is obtained by the cell of the example of a comparison in the narrow range whose circulating water flows are 20 cc-min-1 and about cell-1 so that clearly from drawing 7 , in the place where a circulating water flow is smaller than this range, a cel electrical potential difference becomes quite small, and the cel electrical potential difference has become quite small, even place [than this range / where a circulating water flow is larger]. On the other hand, by the cell of an example 1 and an example 2, the high cel electrical potential difference is maintained in the wide range circulating water flow.
[0063] As this reason, by the cell of the example of a comparison, since there are many pores in the distribution substrate for supply of water In the place where a circulating water flow is small, water is not supplied over the whole anode side channel, but it sets on the cell of examples 1 and 2 to the ability not to perform moisturization of the whole solid-state poly membrane. In that water is supplied over the whole anode side channel even if a circulating water flow is small since there are few pores in the distribution substrate for supply of water, and a list, by the cell of the example of a comparison Since water is continuously supplied to each anode side channel, if a circulating water flow is large, it will set on the cell of examples 1 and 2 to what a channel tends to blockade with the meniscus of water. Since water is not continuously supplied to each anode side channel, even if a circulating water flow is large, lock out of a channel is considered for being hard to generate.
[0064] [Experiment 2] Continuous running of the cell of examples 1 and 2 and the example of a comparison was carried out on the same conditions as the above-mentioned experiment 1, controlling a circulating water flow in optimum dose as follows, and a change of a cel electrical potential difference (mV) with time was measured.
The cell of an example 1: Switch the water of 20 cc-min-1 and cell-1 to the 1st channel group and the 2nd channel group at intervals of 5 minutes, and supply it to them.
[0065] The cell of an example 2: Switch the water of 20 cc-min-1 and cell-1 to the 1st channel group and the 2nd channel group at intervals of 5 minutes, and supply it to them. However, the interval which passes only fuel gas is prepared in the 1st channel group and the 2nd channel group (all channels) for 1 minute between the switches for 5 minutes.
The cell of the example of a comparison: It is continuation supply to all channels about the water of 20 cc-min-1 and cell-1.
[0066] Drawing 8 is the property Fig. which shows this experimental result and expressed the relation between operation time and an average cel electrical potential difference (mV). Compared with the cell of the example of a comparison, the fall of a cel electrical potential difference with time is small by the cell of examples 1 and 2 so that clearly from drawing 8 . By the cell of the example of a comparison, since water is not continuously supplied to each channel by the cell of examples 1 and 2 for a long time to the thing to which the cel engine performance tends to fall with time since water is continuously supplied to each channel, this is considered because the cel engine performance cannot fall easily.
[0067]
[Effect of the Invention] As explained above, the polymer electrolyte fuel cell of this invention A fuel gas supply means to supply fuel gas to an anode side [two or more] channel, A 1st water supply means to supply water to the 1st channel group chosen from anode side [two or more] channels, It was made to make it perform, having established a 2nd water supply means to supply water to said 2nd channel group chosen from the anode side channels of a book, and switching the water supply by the 1st water supply means, and the water supply by the 2nd water supply means by turns without overlapping the 1st channel group. [two or more]
[0068] Or a 1st water supply means to supply water to the 1st channel group and a 1st fuel gas supply means to supply fuel gas to the 1st channel group, While establishing a 2nd water supply means to supply water to the 2nd channel group, and a 2nd fuel gas supply means to supply fuel gas to the 2nd channel group, switching the water supply by the 1st water supply means, and the water supply by the 2nd water supply means by turns and performing them The fuel gas supply by the 1st fuel gas supply means and the fuel gas supply by the 2nd fuel gas supply means are switched by turns, and it was made to perform them.

[0069] and this -- comparatively little supply -- since it does not say that water is continuously supplied to each anode side channel while amount of water can also moisturize over the whole solid-state poly membrane, the lock out by the meniscus of a channel can also be lessened and the fall of the cel engine performance by lock out with time can also be lost. In the above point, it can be said that the cell property which was more economical than before in the fuel cell list of this invention, and was excellent in it is acquired. [of the operating method]

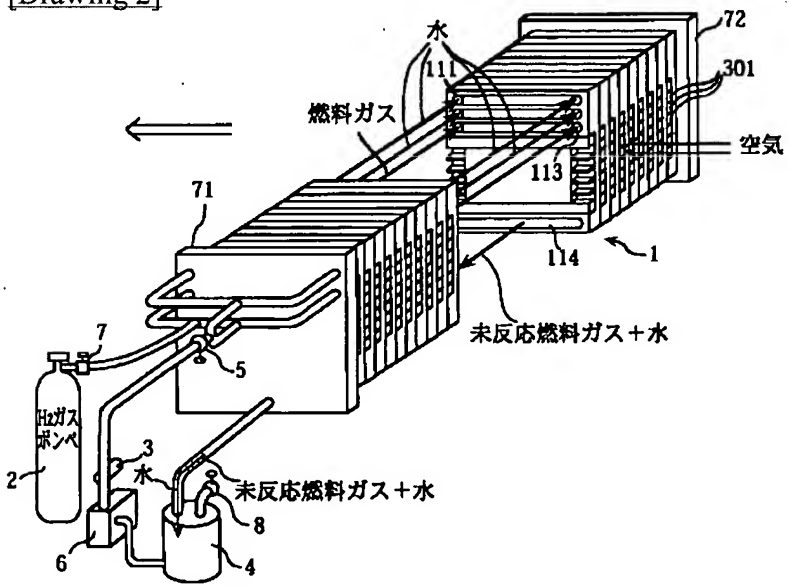
[Translation done.]

DRAWINGS

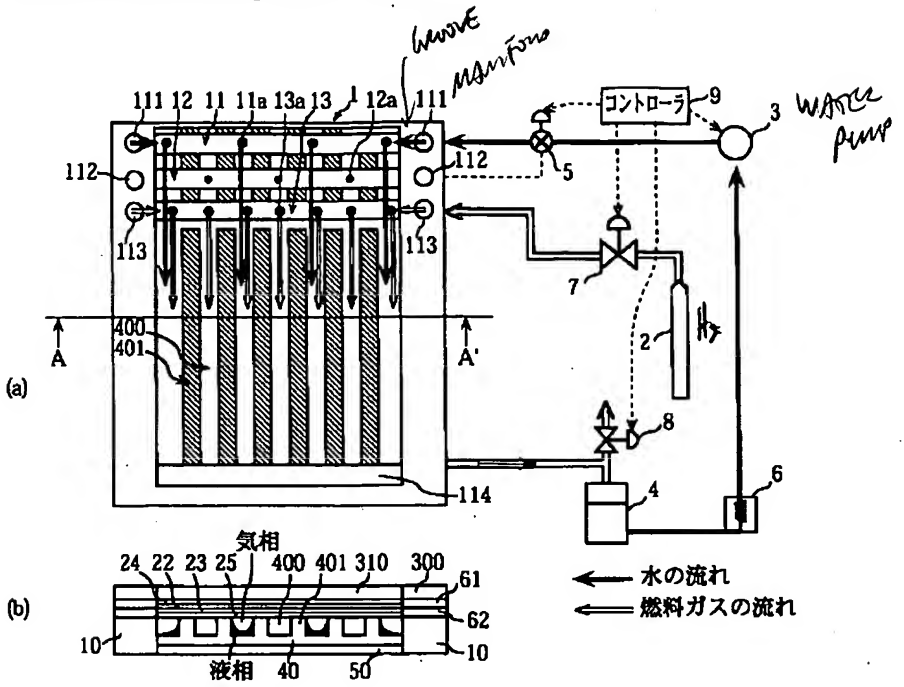
[Drawing 1]



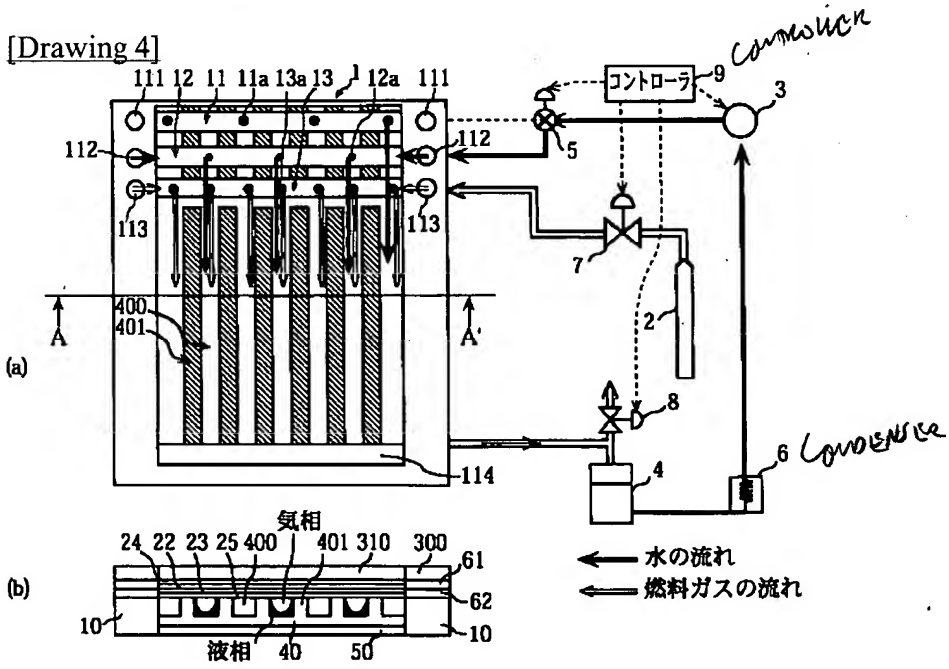
[Drawing 2]



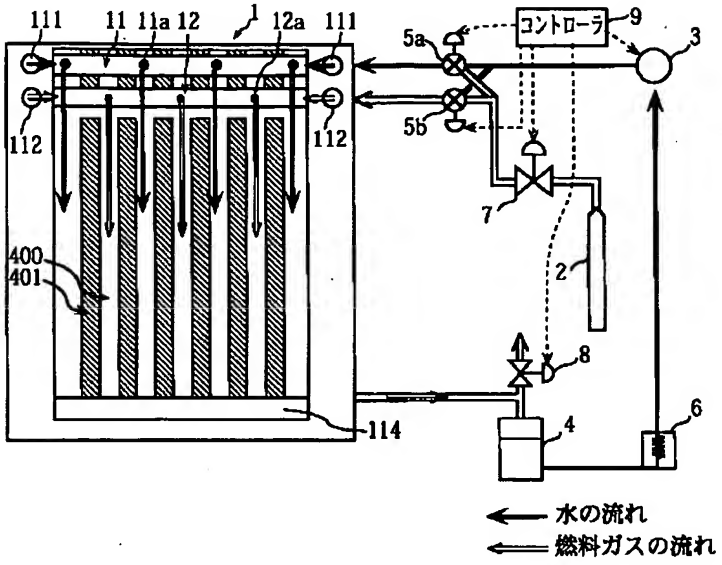
[Drawing 3]



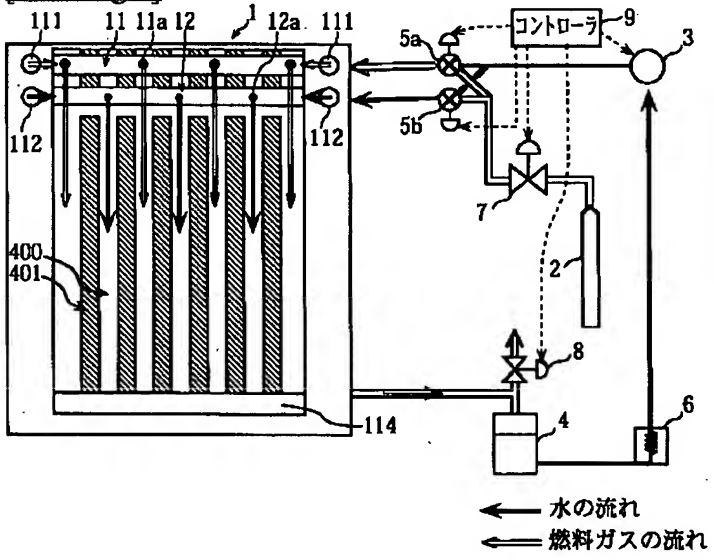
[Drawing 4]



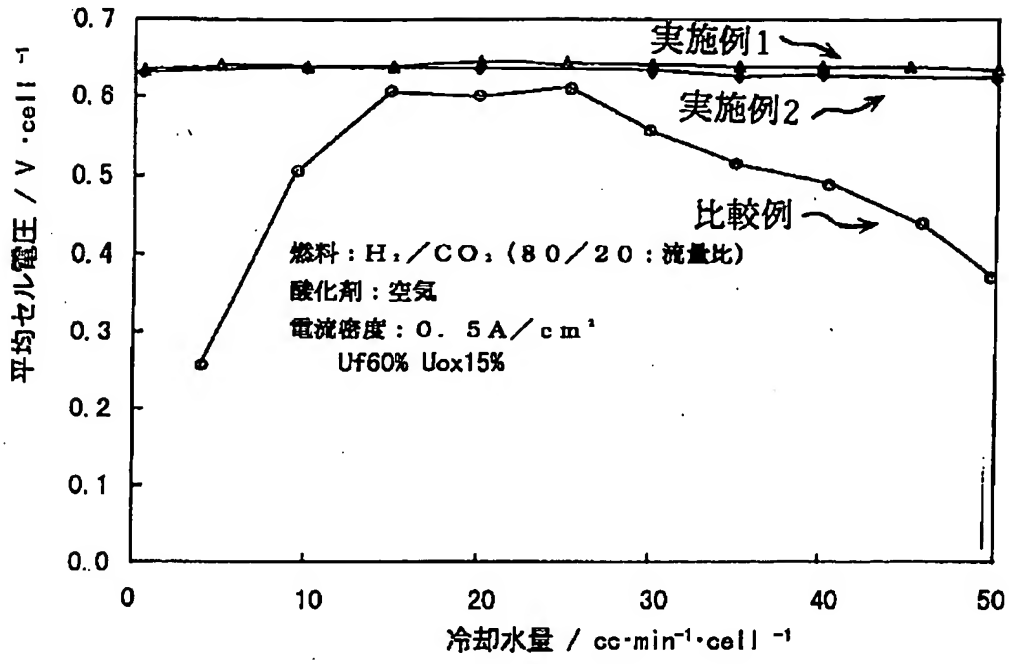
[Drawing 5]



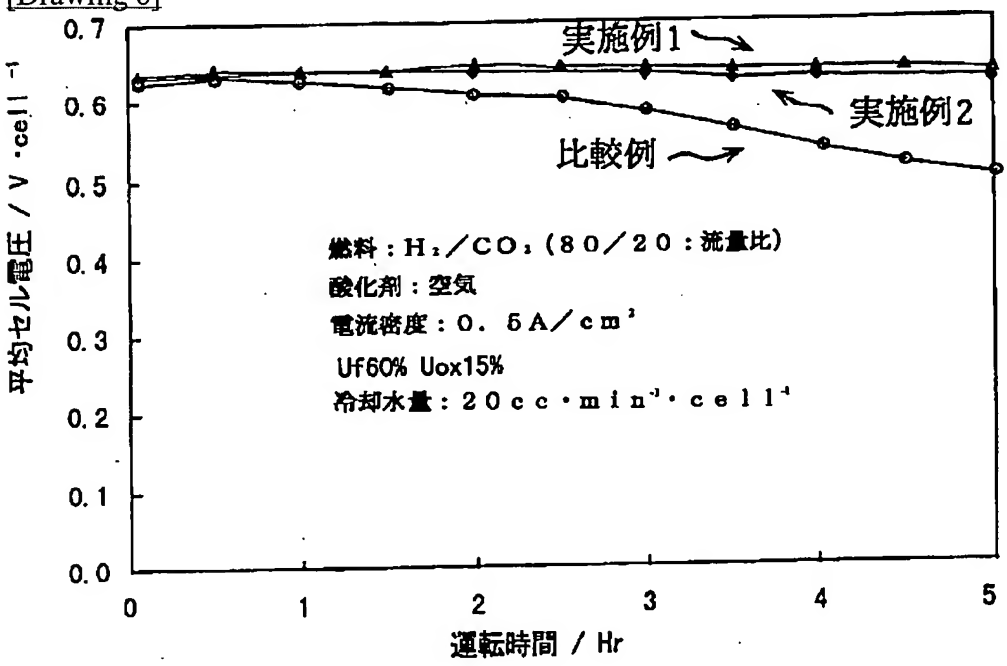
[Drawing 6]



[Drawing 7]



[Drawing 8]



[Translation done.]